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Indian Standard

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गन्ना दलित्र जाँच पद्धति

(पहला पुनरीक्षण)

Sugarcane Crushers — Test Method

(First Revision)

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Agriculture and Food Processing Equipment Sectional Committee, FAD 20

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Agriculture and Food Processing Equipment Sectional Committee had been approved by the Food and Agriculture Division Council.

Sugarcane crusher is the machine used for crushing the sugarcane in order to obtain juice. This machine is used by common hawkers selling the juice roadside. The other user are sugar mills and vinegar making factories.

This standard was first published in the year 1971 and this revision has been taken up to update the standard in line with the latest technological developments. The important changes from the previous version is inclusion of the clause on test at load (*clause* **7**) and reduced juice extraction formula (*clause* **9.6**), incorporation of Annex on crop parameters (Annex H) and a Table of reduced juice extract at 12.5 percent fibre content (Annex H).

In preparation of this standard, valuable assistance has been rendered by the ICAR-Indian Institute of Sugarcane Research, Lucknow and Tamil Nadu Agricultural University, Coimbatore.

The composition of the Committee, responsible for the formulation of this standard is given at Annex K.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.

Indian Standard

SUGARCANE CRUSHERS — TEST METHOD

(First Revision)

1 SCOPE

This standard specifies methods for type and routine testing of sugarcane crushers.

2 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

2.1 Absolute Juice — All the dissolved solids in the cane plus the total liquid content in the cane, that is, cane minus fibre.

2.2 Bagasse — The fibrous residue obtained after crushing the cane *i.e.* after extraction of juice.

2.3 Brix — The percent by weight of solid matter present in the juice as indicated by a brix spindle or calculated from other densimetric measurements.

2.4 Fibre The dry water-insoluble matter in the cane.

2.5 Juice Extraction — The weight of juice extracted from cane by the crusher.

2.5 Juice Extraction (Percent Cane Basis) — The weight of juice extracted from known quantity of sugarcane and expressed in percent.

2.6 Pol — The value determined by direct or single polarization of the normal solution in a saccharimeter.

2.7 Routine Tests — Tests carried out on each crusher to check the requirements which are likely to vary during production.

2.8 Type Tests — Tests carried out on crushers to prove conformity with the requirements of the relevant standard. These are intended to prove the general qualities and design of a given type of sugarcane crusher.

3 TYPE TESTS

The following shall constitute the type tests:

- a) Checking of dimensions of all the parts;
- b) Checking of material and its hardness;
- c) Visual observations before run test;
- d) Test at no load:
  - 1) Power consumption — (for power operated crushers only); and
  - 2) Visual observations.
- e) Test at load:
  - 1) Power consumption;
  - 2) Crushing capacity;
  - 3) Extraction efficiency;
  - 4) Fibre percent in cane;
  - 5) Reduced juice extraction;
  - 6) Visual observations;
  - 7) Juice content in bagasse; and
  - 8) Roller spacing adjustment.

4 ROUTINE TESTS

The following shall constitute the routine tests:

- a) Visual observations before run test, [*see* **3.1** (c)].
- b) Test at no load, [*see* **3.1** (d)]:
  - 1) Power consumption, [*see* **3.1** (d) (1)]; and
  - 2) Visual observations, [*see* **3.1** (d) (2)].

5 CHECKING OF DIMENSIONS

The dimensions measured in millimetres shall be reported as given in Annex A.

6 CHECKING OF MATERIAL AND HARDNESS

The material of construction of major components, hardness of rollers and other details shall be checked and reported as given in Annex B.

7 VISUAL OBSERVATIONS BEFORE RUN TESTS

The observations as given in Annex C shall be made visually and reported.

8 TEST AT NO LOAD

8.1 Install the crusher in accordance with manufacturer's recommendations and set the clearances as given below, ensuring that the clearances are uniform throughout the face length of rollers:

King to crushing roller	6.4 mm
King to extracting roller	0.8 mm

8.2 Operate the crusher for at least 30 min continuously at no-load. Animal power may be used for animal-drawn crushers and electric motor of appropriate power duly fitted with a power meter shall be used for power-operated crushers.

8.3 Take the reading of power meter at an interval of 5, 10, 15, 20, 25 and 30 min. The average of difference between two consecutive readings shall give average power consumption for five minutes. Power consumption at no load for one hour shall be calculated and reported as given in Annex D.

8.4 Observations during and after completing test at no load shall also made and reported as given in **D-2**, for both animal and power operated crushers.

9 TEST AT LOAD

9.1 Pre-test Requirements

9.1.1 Install and set the crusher as in **8.1**.

9.1.2 *Cane*

Take sufficient quantity of freshly harvested cane which should be free from field trash, roots, dirt, etc. The cane should, as far as possible, be of uniform diameter and length. Record cane parameters as per Annex H. Bundles of 25 kg of cane shall be prepared. The canes shall not be soaked in water and the rind should not be scrapped or removed before test.

9.2 Power Consumption

9.2.1 *Animal-driven Crushers*

9.2.1.1 Operate the crusher by a pair of animal preferably bullocks for a period of one hour. The animal shall be properly attached with wooden beam by means of rope or chain and move at an average radius of 4.2 metres. A dynamometer shall be attached between beam and yoke for recording the pull.

9.2.1.2 Continuous feeding of three canes at a time shall be maintained.

9.2.1.3 Revolutions shall be counted manually for the whole period of test and average revolutions per minute should be calculated. Average speed of 1.5 rev/min should be preferred.

9.2.1.4 The reading of dynamometer shall be taken for the whole period of test at an interval of 10 min. The average of the readings taken would represent the average pull required.

9.2.1.5 Power requirement shall be calculated by the following formula:

Power requirement in kW =

$$\frac{\text{Pull in kgf} \times \text{speed in m/s}}{75} \times 0.7355$$

OR

Power requirement in kW

$$\frac{2\pi \times \text{Pull in kgf} \times \text{Radius of movement in m} \times \text{speed in rev./min.} \times 0.7355}{4500}$$

9.2.1.6 Record the data as given in Annex E.

9.2.2 *Power-operated Crushers*

9.2.2.1 Power delivered to the crushers may be supplied either by direct coupling the prime move with the crusher, or by connecting the crusher with prime mover with the help of flat or V-belt and pulleys or by gears. In earlier case, the power delivered to the crusher would be the power output in the prime mover but in latter case the allowances for flat belt, V-belt and gear drive losses may be taken as 5, 2 and 10 per cent respectively.

9.2.2.2 Operate the crusher by a suitable prime mover (electric motor preferred) for a period of one hour. The prime mover may be either direct coupled of may be connected with V-belts of flat belts of gears. A power meter or some form of transmission dynamometer shall be fitted.

9.2.2.3 Continuous feeding of three canes at a time shall be maintained.

9.2.2.4 The speed shall be measured by a revolution counter or by an accurately calibrated tachometer.

9.2.2.5 The reading of the power meter or dynamometer shall be taken for the whole period of test at an interval of 10 min:

a) In case of power meter, the average of difference between two consecutive readings shall give average power consumption for 10 min. The power consumption at load for one hour shall be calculated giving allowances to type of drives (*see* **9.2.2.1**); and
b) In case of dynamometer the average of the reading taken shall give the average pull required. Power requirement shall be calculated by the formula given under **9.2.1.5** after giving the allowances to drive (*see* **9.2.2.1**).

9.2.2.6 The data shall be recorded as given in Annex E.

9.3 Crushing Capacity

9.3.1 Operate the crusher in accordance with the method described in **9.2.1.1** or **9.2.2.2** with continuous feeding of 3 canes at a time for a minimum period of one hour. The time of starting and stopping and any time lost during the test shall be recorded correctly.

9.3.2 Deduct the weight of cane left from the weight of cane taken for the test. The value thus obtained shall represent the weight of cane crushed during the period.

The crushing capacity per hour may also be calculated by following formula:

Crushing capacity in kg/kWh =

$$\frac{\text{Cane crushed during one hour in kg}}{\text{Total energy consumed in kWh}}$$

9.3.3 Record the data as given in Annex E.

9.4 Juice Extraction Efficiency

9.4.1 The minimum of 25 kg of cane and crush it by operating the crusher in accordance with **9.2.1.1** or **9.2.2.2** as the case may be.

9.4.2 The juice shall be collected in vessel of known weight. Juice shall be passed in vessel through a screen of preferably 180 microns IS Sieve. Care shall be taken that no juice is stuck with the crusher or leaked through any source.

9.4.3 Take the weight of vessel containing juice after being sure that all the air from the juice has escaped.

9.4.4 Net weight of the juice shall be obtained by deducting the weight of vessel. Also record the temperature of the juice.

9.4.5 Carefully collect all the bagasse and take its weight.

9.4.6 From **9.4.4** and **9.4.5**, juice extracted and bagasse obtained for 100 kg of cane shall be calculated and data shall be recorded as given in Annex E.

9.5 Fibre Content in Cane

9.5.1 The juice shall be analysed for pol and brix according to the method given in Annex F.

9.5.2 Bagasse shall be analysed for pol and moisture content according to the method given in Annex G.

9.5.3 Care shall be observed that bagasse shall be analysed immediately after crushing and the juice shall be kept for setting in cool place for atleast 30 min.

9.5.4 From analyses made in **9.4.6**, **9.5.1** and **9.5.2** above, fibre in cane shall be calculated by following formulae:

a) Purity of extracted juice (%) =

$$\frac{\text{pol percent of juice}}{{}^{\circ}\text{Brix percent of juice}} \times 100$$

b) Brix percent bagasse (%) =

$$\frac{\text{pol percent bagasse}}{\text{Purity of extracted juice}} \times 100$$

c) Fibre percent bagasse (%) = 100 – (Moisture content of bagasse on w.b. + °Brix percent of bagasse)

d) Fibre percent cane (%) =

$$\frac{\text{Fibre percent bagasse}\,(\%) \times \text{Bagasse percent cane}\,(\%)}{100}$$

9.5.5 The data shall be recorded as given in Annex E.

9.6 Reduced Juice Extraction

9.6.1 As juice extraction percent would vary according to fibre content in cane, for the purpose of uniformity and comparison of data, the juice extraction obtained in **9.4.6** shall be corrected on the basis of 12.5 percent fibre content in cane by following formula:

$$\text{RE} = \frac{12.5}{\text{FC}}[\text{JE} - 100] + 100$$

where

RE = Reduced juice extraction, percent cane;

FC = Fibre content, percent cane; and

JE = Actual juice extraction, percent cane.

With this formula, a table depicting reduced juice extraction from fibre content cane and actual juice extraction has been given in Annex J.

9.6.2 The data shall be recorded as given in Annex E.

9.7 Visual Observations

During and after completing the test at load, the observations mentioned in **E-6** shall be made visually and reported.

ANNEX A

(*Clause* 5)

DIMENSIONAL DATA SHEET

A-1 DIAMETER OF ROLLER

a) King
b) Crushing
c) Extracting

A-2 LENGTH OF ROLLER

a) King
b) Crushing
c) Extracting

A-3 NUMBER OF GROOVES IN ROLLER

a) King
b) Crushing
c) Extracting

A-4 DIAMETER OF AXLE FOR ROLLER

a) King
b) Crushing
c) Extracting

A-5 DIAMETER OF BEARINGS

a) King
b) Crushing
c) Extracting

A-6 BEARING AND AXLE CLEARANCES

a) King
b) Crushing
c) Extracting

A-7 LENGTH OF BEARINGS

a) King
b) Crushing
c) Extracting

A-8 ROLLER CLEARANCE BETWEEN

a) King and crushing
   1) Maximum
   2) Minimum
b) King and extracting
   1) Maximum
   2) Minimum

A- 9 GEARS

a) Number of gears
b) Number of teeth in gears
c) Length of gear teeth
d) Width of gear teeth
e) Height of gear teeth

Testing Engineer

ANNEX B

(*Clause* 6)

MATERIAL AND HARDNESS DATA SHEET

a) Total weight of sugarcane crusher
b) Hardness of rollers at machined surface
c) Material of construction of different components

Sl No.	Name of Part	Material Material
i)	Rollers	
ii)	Axles	
iii)	Gears	
iv)	Bearings	
V)	Frame	
Vi)	Juice pan	
vii)	Others parts	

Testing Engineer

ANNEX C

(*Clause* 7)

DATA SHEET FOR VISUAL OBSERVATION BEFORE RUN TEST

a) Presence of blow holes, cracks and physical damage.
b) Provision for safety at feeding point.
c) Provision of sufficient lubrication.
d) Provision for protection of bearings from entry of juice.
e) Provision for covering of gear train in power-operated crusher.
f) Interchangeability of parts.
g) Attachment of different parts.
h) Any other observation.

Testing Engineer

ANNEX D

(*Clauses* 8.3 *and* 8.4)

TEST AT NO LOAD DATA SHEET

D-1 POWER CONSUMPTION

a) Source of power;
b) Total time of run;
c) Readings of powermeter at interval of five minutes;
d) Average power consumption for five minutes; and
e) Average power consumption for one hour.

D-2 VISUAL OBSERVATIONS

a) Presence of undue shock, hammering or other defects;
b) Running of rollers and axles in their respective bearing;
c) Rise in bearing temperature;
d) Any marked unusual wear or slackness in any component;
e) Smooth running of gear;
f) Compactness and rigidity of construction; and
g) Any other observation.

ANNEX E

(*Clauses* 9.2.1.6, 9.2.2.6, 9.3.3, 9.4.6, 9.5.5, 9.6.2 *and* 9.7)

TEST AT LOAD DATA SHEET

E-1 POWER CONSUMPTION

a) Type of power,
b) Type of drive,
c) Average reading of dynamometer or power meter,
d) Speed:
    1) rev/min
    2) m/s
e) Average power consumption in Kw.

E-2 CRUSHING CAPACITY

a) Total weight of cane taken for test;
b) Starting time;
c) Stopping time;
d) Time lost during the run;
e) Total actual working time;
f) Weight of cane left after run;
g) Total weight of cane crushed; and
h) Crushing capacity:
    1) per hour
    2) per kWh

E-3 JUICE EXTRACTION

a) Total actual working time;
b) Total weight of cane crushed;
c) Weight of empty vessel;
d) Weight of vessel with juice;
e) Weight of juice;
f) Temperature of juice;
g) Weight of bagasse;
h) Juice obtained per 100 kg of cane;
j) Bagasse obtained per 100 kg of cane; and
k) Any other matter obtained.

E-4 FIBRE PERCENT CANE

a) Pol percent in juice;
b) Brix percent in juice;
c) Purity of juice;
d) Pol percent bagasse;
e) Brix percent bagasse;
f) Moisture percent bagasse;
g) Fibre percent bagasse; and
h) Fibre percent cane.

E-5 REDUCED JUICE EXTRACTION

E-6 VISUAL OBSERVATIONS

a) Presence of undue shock, hammering or other defects;
b) Running of rollers and axles in their respective bearing;
c) Rise in bearing temperature;
d) Compactness and rigidity of construction;
e) Running of gear train;
f) Any marked unusual wear or slackness in any component; and
g) Any other observation.

ANNEX F

(*Clause* 9.5.1)

DETERMINATION OF BRIX AND POL OF JUICE

F-1 BRIX DETERMINATION

F-1.1 Procedure

Mix the juice thoroughly and pass through a sieve, preferably 106-micron IS Sieve. Fill a vertical cylinder to overflow. Allow the air to escape by standing for 20 minutes; alternatively, the air may be removed by applying vacuum. Gradually lower the graduated brix spindle. Take the reading of the spindle in line with the plane surface of the liquid, after spindle becomes steady and attains the juice temperature. Also record the temperature of the juice by a thermometer.

The spindle reading at a particular temperature with spindle correction (if any) would give the brix content in juice at observed temperature.

The value thus obtained may be corrected at 20 ºC by the following formula:

$$S_{20} = S_t [1 + 0.003 (t - 20)]$$

where

S_{20} = spindle reading at 20ºC, and
S_t = spindle reading with spindle correction at t ºC.

NOTE — This formula is applicable only up to 30 °C.

F-2 POL DETERMINATION

F-2.1 Procedure

Mix the juice thoroughly and pass through a sieve, preferably 106-micron IS Sieve. Fill a 100 ml flask with juice and add about 0.6 g of dry acetate.

Place the stemless funnel over the glass cylinder and fix a cone of dry filter paper large enough to hold 100 ml in the funnel. Pour the whole of the defecated solution on the cone of the dry filter paper and cover it immediately with the watch-glass. Reject the first 10 to 15 ml of the filtrate. Rinse the glass cylinder with a little quantity of filtrate and discard the solution used for rinsing. Collect the remainder of the filtrate into rinsed cylinder. Polarize the filtrate in the saccharimeter at 20 °C, as far as possible, using a 200-mm tube. The reading gives the polarization percent of the juice.

If the polarization is done at a temperature other than 20 ºC, the saccharimeter reading shall be corrected using the formula:

$$S_{20} = S_t [1 + 0.003 (t - 20)]$$

where

S_{20} = saccharimeter reading at 20 °C, and
S_t = saccharimeter reading at t °C.

NOTE — This formula is applicable only up to 30 °C.

ANNEX G

(*Clause* 9.5.2)

DETERMINATION OF MOISTURE CONTENT AND POL OF BAGASSE

G-1 MOISTURE CONTENT

G-1.1 Procedure

Take 100 g of the bagasse in a metallic container, perforated on all sides. Dry in a suitable oven at about 110 ºC temperatures until it reaches constant weight. The loss in weight gives the moisture removed and the moisture content on wet basis may be calculated by the following formula:

$$\mathrm{M}\ \% = \frac{\mathrm{W_m}}{\mathrm{W_i}} \times 100$$

where

M = Moisture content of bagasse on wet basis (percent),

$\mathrm{W_m}$ = Weight of moisture removed (g), and

$\mathrm{W_i}$ = Initial weight of bagasse (g).

G-2 POL DETERMINATION

G-2.1 Procedure

One kilogram of bagasse should be gently boiled for one hour under reflux with ten times its quantity of water. One gram of sodium carbonate per litre of water should be added in order to prevent inversion. The extract is clarified with anhydrous lead acetate. Filter the clarified extract ad polarize the filtrate in the saccharimeter at 20 ºC as far as possible using 400 mm tube. After taking into account the moisture content in bagasse and the polarization in the 400-mm tube, the pol percent in bagasse may be calculated by the following formula:

$$\text{Pol percent in bagasse} = \frac{26\,P\left(W_1 + W_2\right)}{200 \times W_3}$$

where

P = polarization in 400 mm tube,

W_1 = weight of water taken,

W_2 = weight of water in bagasse, and

W_3 = weight of bagasse

ANNEX H

CROP PARAMETERS

H-1 VARIETY AND MATURITY

a) Sugarcane variety

b) Plant/ratoon

c) Date of planting

d) Date of harvesting

H-2 PHYSICAL PARAMETERS

a) Average length of cane, m;

b) Average diameter of cane (measured at top, middle and bottom), mm; and

c) Weight of cane per metre length, kg.

ANNEX J

Reduced juice extraction at 12.5 percent fibre content

Fibre, percent cane	10.0	10.5	11.0	11.5	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0
Extn, percent cane																	
55	43.75	46.43	48.86	51.09	53.13	55.00	56.73	58.33	59.82	61.21	62.50	63.71	64.84	65.91	66.91	67.86	68.75
56	45.00	47.62	50.00	52.17	54.17	56.00	57.69	59.26	60.71	62.07	63.33	64.52	65.63	66.67	67.65	68.57	69.44
57	46.25	48.81	51.14	53.26	55.21	57.00	58.65	60.19	61.61	62.93	64.17	65.32	66.41	67.42	68.38	69.29	70.14
58	47.50	50.00	52.27	54.35	56.25	58.00	59.75	61.11	62.50	63.79	65.00	66.13	67.19	68.18	69.12	70.00	70.83
59	48.75	51.19	53.41	55.43	57.29	59.00	60.58	62.04	63.39	64.66	65.83	66.94	67.97	68.94	69.85	70.71	71.53
60	50.00	52.38	54.55	56.52	58.33	60.00	61.54	62.96	64.29	65.51	66.67	67.74	68.75	69.70	70.59	71.43	72.22
61	51.25	53.57	55.68	57.61	59.38	61.00	62.50	63.89	65.18	66.38	67.50	68.55	69.53	70.45	71.32	72.14	72.19
62	52.50	54.76	56.82	58.70	60.42	62.00	63.46	64.81	66.07	67.24	68.33	69.35	70.31	71.21	72.06	72.86	73.61
63	53.75	55.95	57.95	59.78	61.46	63.00	64.42	65.74	66.91	68.10	69.17	70.16	71.09	71.97	72.79	73.57	74.31
64	55.00	57.14	59.09	60.87	62.50	64.00	65.38	66.67	67.86	68.97	70.00	70.97	71.88	72.73	73.53	74.29	75.00
65	56.25	58.33	60.23	61.96	63.54	65.00	66.35	67.59	68.75	69.83	70.83	71.77	72.66	73.48	74.26	75.00	75.69
66	57.50	59.52	61.36	63.04	64.58	66.00	67.31	68.52	69.64	70.69	71.67	72.58	73.44	74.24	75.00	75.71	76.39
67	58.75	60.71	62.50	64.13	65.63	67.00	68.27	69.44	70.54	71.55	72.50	73.39	74.22	75.00	75.74	76.43	77.08
68	60.00	61.90	63.64	65.22	66.67	68.00	69.23	70.37	71.43	72.41	73.33	74.19	75.00	75.76	76.47	77.14	77.78
69	61.21	63.10	64.77	66.30	67.71	69.00	70.19	71.30	72.32	73.28	74.17	75.00	75.78	76.52	77.21	77.86	78.47
70	62.50	64.29	65.91	67.39	68.75	70.00	71.15	72.22	73.21	74.14	75.00	75.81	76.56	77.27	77.94	78.57	79.17
71	63.75	65.48	67.05	68.48	69.79	71.00	72.12	73.15	74.11	75.00	75.83	76.61	77.34	78.03	78.68	79.29	79.86
72	65.00	66.67	68.18	69.57	70.83	72.00	73.08	74.07	75.00	75.86	76.67	77.42	78.13	78.79	79.41	80.00	80.56

ANNEX K

(*Foreword*)

COMMITTEE COMPOSITION

Agriculture and Food Processing Equipments, FAD 20

Organization	*Representative(s)*
Indian Council of Agricultural Research, New Delhi	Dr K. Alaglusundaram (***Chairman***)
C C S Haryana Agricultural University, Hisar	Dr M. K. Garg
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Shri Pawan Kumar
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BIBLIOGRAPHY

Babboo, B. and Anwar, S.I. 1994. Recent Developments in Jaggery (Gur) Research. Tech. Bull. No. IISR/JKS/94/9. Indian Institute of Sugarcane Research, Lucknow

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Amendments Issued Since Publication

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Eastern	: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi KOLKATA 700054	2337 8499, 2337 8561 2337 8626, 2337 9120
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